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Science and Technology for Tomorrow's Air and Space Force

Success Story

NEW SILICON-BASED, LIGHT-EMITTING TECHNOLOGY SETS A WORLD RECORD FOR EFFICIENCY

STMicroelectronics' new silicon-based, light-emitting technology sets a world record for efficiency. It traces its creative origins back to important research funded by the Air Force Office of Scientific Research and conducted jointly in 1993 by the Air Force Research Laboratory, at Hanscom Air Force Base, Massachusetts, and the Massachusetts Institute of Technology. The team's work in rare-earth-doped, light-emitting diodes leads the nation and inspired the STMicroelectronics' innovation that implants ions of rare-earth metals, such as erbium or cerium, in a layer of silicon-rich oxide.

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Accomplishment

STMicroelectronics discovered groundbreaking technology that allows silicon-based light emitters to match the efficiency of traditional light-emitting compound semiconductor materials such as gallium arsenide. STMicroelectronics is the world's third largest semiconductor manufacturer.

This new technology opens up many potential applications to combine optical and electrical functions on a single silicon chip. Although silicon is ideal for building memories, microprocessors, and other complex circuits, this was not previously possible because it could not act as an efficient light emitter.

Background

Mr. GianGuido Rizzotto, STMicroelectronics Director of Corporate Technology Research and Development, identified a number of promising applications and solved key manufacturing issues to rapidly move this technology into production. One of the first applications is building power control devices in which the control circuitry is electrically isolated from the power-switching transistors. Currently, manufacturers achieve electrical isolation, mandatory in many applications for safety reasons, by using external devices such as relays, transformers, or discrete optocouplers.

STMicroelectronics patented a novel structure in which two circuits, built on the same chip but electrically separated from each other by insulating silicon dioxide, communicate via optical signals using integrated silicon light emitters and detectors. These devices will have numerous important applications including motor control, power supplies, solid-state relays, and similar applications where the power circuit needs to handle much higher voltages than the control circuit.

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Additional information

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